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U.S. PATENT APPLICATION
for
DOUBLE THROW SWITCH LINKAGE

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DOUBLE THROW SWITCH LINKAGE

BACKGROUND OF THE INVENTION

[0001] The present invention is directed to linkages for controlling switches
5 and more particularly to a linkage for use as a double throw switch for controlling two
switches mounted in the same enclosure so that only one switch can be on at any
given time.

[0002] Switching apparatus generally referred to as a double throw switch is
commonly used to alternatively connect one of two load devices to a source of electric
10 power or to connect a single load device alternatively to one of two separate sources
of electric power. For example, two lines coming into a switch tied to one load
coming out of the switch as in a system that has an emergency power generator to
switch from normal power source to the emergency generator. Another example is
one line coming into a switch tied to two loads coming out of the switch as in a
15 system that has a backup pump that needs to operate when the main pump is off line.
The two switch mechanisms are tied together with a linkage. The linkage allows only
one switch to be turned on at a time. Prior linkages typically are assembled using
multiple slots in a plate which is secured to a framework by multiple fasteners or
rivets which slide in the plurality of slots.

20 [0003] There is a need for a double throw switch linkage that requires fewer
parts for assembly thereby reducing costs and complexity.

SUMMARY OF THE INVENTION

[0004] There is provided a double throw switch linkage for coupling two
switch apparatuses together in an enclosure. Each switch apparatus is coupled to the
25 switch mechanism having a switch mechanism lever arm. The double throw switch
linkage comprises an interlock housing, with the interlock housing defining a pair of
actuator plate slots and a first orifice and a second orifice. Each orifice is configured

to provide unimpeded passage of each switch mechanism lever arm. An actuator plate is slidably mounted in the actuator plate slots. The actuator plate is free floating in the interlock housing. The actuator plate defines a first switch slot, a second switch slot, and a driver arm slot. Each switch slot is configured to guide a pin mounted on each switch mechanism lever arm. A lever arm assembly is mounted on a sidewall of the enclosure with the lever arm assembly including a lever arm coupled to a driver arm. The driver arm is configured to engage the driver arm slot and the actuator plate. When the lever arm is moved it translates a force to the actuator plate which closes one switch mechanism and maintains the other switch mechanism in an open position.

[0005] There is also provided an electric double switch comprising an enclosure having at least one sidewall, a bottom wall and a cover. A first switch apparatus, including a first switch mechanism having a lever arm is mounted in the enclosure. A second switch apparatus, including a second switch mechanism having a lever arm, is mounted in the enclosure. A double throw switch linkage is coupled to each of the first and second switch apparatus. The double throw switch linkage comprises an interlock housing, with the interlock housing defining a pair of actuator plate slots and a first orifice and a second orifice. Each orifice is configured to provide unimpeded passage of each switch mechanism lever arm. An actuator plate is slidably mounted in the actuator plate slots. The actuator plate defines a first switch slot, a second switch slot, and a driver arm slot. Each switch slot is configured to guide a pin mounted on each switch mechanism lever arm. A lever arm assembly is mounted on the sidewall of the enclosure. The lever arm assembly includes a lever arm coupled to a driver arm, with the driver arm configured to engage the driver arm slot in the actuator plate. Upon movement of the lever arm, the lever arm translates a force to the actuator plate which closes one switch apparatus and maintains the other switch apparatus in an open position.

[0006] Also provided is a method for interlocking two switch apparatus mounted in an enclosure. Each switch apparatus has a switch mechanism including a switch mechanism lever arm and the enclosure has a cover and a sidewall. The method comprises the steps of providing an interlock housing. The interlock housing

defining a pair of actuator plate slots and a first orifice and a second orifice, with each orifice configured to provide unimpeded passage of each switch mechanism lever arm. Mounting the interlock housing in the enclosure adjacent to the switch mechanisms. Providing an actuator plate, with the actuator plate defining a first switch slot, a second switch slot and a driver arm slot. Each switch slot is configured to guide a pin mounted on each switch mechanism lever arm. Inserting the actuator plate in each actuator plate slot for free sliding movement. Aligning the pin on each switch mechanism arm in one of the first and second switch slots in the actuator plate. Mounting a lever arm assembly on the sidewall of the enclosure, with the lever arm assembly including a lever arm coupled to a driver arm. Aligning the driver arm to engage the driver arm slot in the actuator plate. Moving the lever arm to translate a force to the actuator plate wherein one switch apparatus is closed and the other switch apparatus is maintained in an open position. An alternative embodiment for the method includes the step of providing an interlock release mechanism coupled to the cover and the interlock housing, wherein the cover can be opened if one of the switch apparatus is closed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a perspective view of an exemplary embodiment of an electrical enclosure housing two switch apparatus coupled to an exemplary embodiment of a double throw switch linkage.

[0008] Fig. 2 is an exploded perspective view of an exemplary embodiment of a double throw switch linkage.

[0009] Fig. 3 is an exploded perspective view of an exemplary embodiment of a double throw switch linkage illustrating the mounting of the lever arm assembly to a sidewall of an enclosure.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0010] Referring to the figures, Fig. 1 illustrates an exemplary embodiment of a double throw switch linkage 30 mounted in an enclosure 10 and coupled to a pair of switch mechanisms 22. Each switch mechanism 22 is coupled to a switch

apparatus 20. The enclosure 10 typically includes sidewalls 12, a bottom wall 14 and a cover 16. The switch apparatus 20, typically are configured for multiple phase connections and can be rated at 30 to 200 amps. For such ratings, the enclosures are typically North American Electrical Manufacturers Association (NEMA) Type 1, 3R, 4X and 12. Switch enclosures may also be configured to accommodate switch apparatus 20 that are rated in the range of 400 to 1200 amps. In such cases, the enclosures typically are NEMA Type 1 and 3R. It is contemplated, that other current rating and enclosure configurations can be suitable for the double throw switch linkage disclosed herein.

10 **[0011]** A double throw switch is actually two switch apparatus 20 combined in a single enclosure 10. The switch mechanisms 22 are coupled together with a double throw switch linkage 30. The double throw switch linkage 30 allows only one switch to be turned on at any given time.

15 **[0012]** A typical operating sequence for a double throw switch mechanism provides that the lever arm 66 of a lever arm assembly 60 is positioned in an "OFF" position which typically is a mid-point between the two "ON" positions. In such position, both switch apparatus 20 are "OFF". If an operator, for example, moves the lever arm 66 in one direction (indicated by the arrows in Fig. 1) one of the switch apparatus 20 will be closed and energized. The lever arm 66 is typically at the upper limit of the handle throw, for example in Fig. 1, lever 66 would be moved in the direction towards the top of Fig. 1. An operator moves the lever arm 66 back to the mid or "OFF" position, the first switch would be in the open or "OFF" position. When the operator would move the handle 66 to a second position (in the direction of the bottom of Fig. 1) the second switch apparatus 20 would be closed or energized and the first switch apparatus 20 would still be in the "OFF" position. By moving the lever arm 66 back to the mid point position, the second switch apparatus 20 would be returned to the "OFF" position.

20 **[0013]** Referring to Figs. 2 and 3, there is illustrated an exemplary embodiment of a double throw switch linkage 30. An interlock housing 32 is configured to define a pair of actuator plate slots 34 and a first orifice 38 and a second orifice 40. Each orifice 38, 40 is configured to provide unimpeded passage of each

switch mechanism lever arm 24. The actuator plate slots 34 are typically stamped from the interlock housing 32 if the actuator plate 50 is metal and are configured in a rectangular shape. The actuator plate slots are aligned with one another on a horizontal axis with one actuator plate slot 34 proximate each end of the interlock housing 32. At approximately the midpoint of the distance between the two actuator plate slots 34, an actuator plate guide 36 may be provided to assist in guiding the actuator plate 50 as will be described below.

[0014] A switch mechanism lever arm 24 is coupled to each switch mechanism 22. A typical coupling includes two screws to mount the switch mechanism lever arm 24. Each switch mechanism lever arm includes a switch mechanism lever arm pin 26. The switch mechanism lever arm 24 passes through each orifice 38, 40 formed in the interlock housing 32 and is not fastened to the interlock housing 32.

[0015] An actuator plate 50 is slidingly mounted in the actuator plate slots 34. The actuator plate 50 free floats in the interlock housing 32 within the actuator plate slots 34. The intermediate actuator plate guide 36 assists in maintaining the orientation of the actuator plate 50 with respect to the interlock housing 32. The actuator plate 50 defines a first switch slot 52 and a second switch slot 54. Each switch slot 52, 54 is proximate each end of the actuator plate 50 and is aligned with the switch mechanism lever arm pin 26. A typical configuration for each switch slot 52, 54 is L-shaped slot. The actuator plate 50 also defines a driver arm slot 56 which is located proximate the midpoint of the actuator plate 50. It should be understood that its location is defined by the relative lateral motion required to actuate the double throw switch linkage 30 to have one switch apparatus 20 open and the other switch apparatus 20 closed.

[0016] A lever arm assembly 60 is mounted on a sidewall 12 of the enclosure 10. (See Fig. 3.) The lever arm assembly 60 includes a lever arm 66 (also referred to as an operating handle) coupled to a driver arm 64. The driver arm 64 is configured to engage the driver arm slot 56 in the actuator plate 50.

[0017] When the lever arm 66 is moved by an operator (as shown by the arrows in Figs. 1 and 4) a force is applied to the actuator plate 50 by the driver arm 64

which moves the actuator plate 50. As the actuator plate 50 is moved, the switch mechanism lever arm pin 26 follows in the actuator plate slot 52, 54 thereby rotating the switch mechanism lever arm 24 and actuating the switch mechanism 22. Because of the actuator plate slot 34 configuration, one of the switch apparatus 20 will be
5 closed (energized) and the other one will be maintained in an open position (unenergized) upon movement of the actuator plate 50 to the end of its stroke.

[0018] An interlock release mechanism 70 is configured to release the cover 16 interlocks so that the cover 16 can be opened with either of the switch apparatus 20 in the "ON" position. An interlock release linkage 74 is coupled to the interlock
10 release bar 72 which is operatively aligned with each switch apparatus and engages the cover 16 interlocks.

[0019] As illustrated in Figs. 1-3, the actuator plate 50 is a single member. The actuator plate 50 can be composed of a material selected from a group including a metal, such as steel, a plastic, a composite material, or any two of such materials. In
15 any event, the material used for the actuator plate 50 should be of a strength and composition that is sufficient and suitable for the mechanical forces exerted upon the actuator plate 50 and the electrical ratings of the switch apparatus 20.

[0020] Thus there has been disclosed a double throw switch linkage for coupling two switch apparatus together in an enclosure, with the double throw switch
20 linkage configured to open one switch apparatus and close another switch apparatus with a single lever arm assembly. Other substitutions, modifications, changes and omissions may be made in the design, operating conditions and arrangement of the preferred and other exemplary embodiments without departing from the spirit of the present invention and as defined in the appended claims.